CLAIMS

What is claimed is:

1. A sensor front end, comprising:

an antenna having an antenna port and a common aperture for transmitting a sensor signal and receiving a reflected signal;

a tri-mode mixer having a first input/output port coupled to the antenna input, a second input/output port, and a first input port, wherein there is a predetermined amount of signal transmitted between the first input port and the first input/output port;

a continuous wave signal source coupled to the first input port of the tri-mode mixer, the continuous wave signal source providing a first signal having a first frequency, a first amplitude and a first phase, wherein a portion of the first signal is transmitted between the first input port and the first input/output port and coupled to the antenna port and is transmitted therefrom as the sensor transmit signal, and wherein the tri-mode mixer receives the reflected signal from the antenna port and mixes the received reflected signal with the first signal and provides, as an output, a baseband video signal; and

a receiver coupled to the second input/output port of the tri-mode mixer such that the baseband video signal provided by the tri-mode mixer is coupled to the receiver via the second output of the transmit-receive switch, the receiver being configured and arranged to provide as an output a sensor output signal.

2. The sensor front end of claim 1 further including:

a transmit-receive switch having an input coupled to the second input/output port of the mixer and first and second outputs;

a phase-modulator coupled to the first output of the transmit-receive switch, wherein when the transmit-receive switch is coupled to the first output, the phase-modulator provides phase-modulation to the tri-mode mixer that phase-modulates the

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first signal transmitted from the first input port to the first input/output port such that the transmitted sensor signal is phase-modulated; and

wherein the receiver is coupled to the second output of the transmit-receive switch and the receiver includes a phase-demodulator configured and arranged to provide a phase-demodulation scheme that is complementary to the phase-modulation scheme provided by the phase-modulator.

3. The sensor front end of claim 1 further including a phase shifter inserted in series between the tri-mode mixer and the antenna port, wherein the phase shifter shifts both the sensor signal to be transmitted and the received reflected signal by a predetermined amount of phase shift.

4. The sensor front end of claim 3 wherein the predetermined amount of phase shift is forty-five degrees.

5. The sensor front end of claim 2 further including a controller coupled to the transmit-receive switch, the phase-modulator, and the phase-demodulator, wherein the controller is configured and arranged to switch the first switch between the first and second outputs at a predetermined pulse repetition rate, the controller further configured and arranged to provide a phase-modulation scheme and a complementary phase-demodulation scheme to the phase-modulator and demodulator respectively.

6. The sensor front end of claim 5 wherein the controller is coupled to the receiver and is configured and arranged to provide a sensitivity time control signal thereto.

7. The sensor front end of claim 1 further including a sampling module coupled to the output of the receiver and configured and

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arranged to receive the sensor output signal and to provide as an output a sampled sensor output signal.

8. The sensor front end of claim 7 further comprising an analog to digital converter coupled to the output of the sampling module and configured and arranged to receive the sampled sensor output signal and to provide as an output a digitized representation of the sampled sensor output signal.

9. The sensor front end of claim 1 wherein the tri-mode mixer is a double balanced mixer.

10. The sensor front end of claim 1 wherein the tri-mode mixer is a single balanced mixer.

11. The sensor front end of claim 2 wherein the transmit receive switch includes first and second electronic switch elements, each electronic switch element including first, second, and third terminals, the third terminal of the first electronic switch coupled to the first terminal of the second electronic switch element and the connection between the third and first terminals of the first and second electronic switch elements coupled to the second input/output port of the tri-mode mixer;

a symmetric pulse generator configured and arranged to provide first and second bipolar output pulses, the first output pulse being coupled to the second terminal of the first electronic switching element and the second output pulse being coupled to the second terminal of the second switching element;

wherein the first and second anti-symmetric pulses are used to turn on either the first or the second electronic switch element and couple the second input/output port of the tri-mode mixer to the first terminal of the first electronic switching element or to the third terminal of the second electronic switching element.

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12. A sensor front end, comprising:

an antenna having an antenna port and a common aperture for transmitting a sensor signal and receiving a reflected signal;

a tri-mode mixer;

a continuous wave signal source coupled to the tri-mode mixer, the continuous wave signal source providing a first signal wherein a portion of the first signal is switched through the tri-mode mixer and coupled to the antenna port and is transmitted therefrom as the sensor signal, and wherein the tri-mode mixer receives the reflected signal from the antenna port and mixes the received reflected signal with the first signal and provides, as an output, a baseband video signal; and

a receiver coupled to the tri-mode mixer such that the baseband video signal provided by the tri-mode mixer is coupled to the receiver, wherein the receiver being configured and arranged to provide a sensor output signal.

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